HL1 Mid-Year Final – Paper 1

Name _____

1. Which molecule is square planar in shape?

A. XeO_4

B. XeF_4

C. SF_4

D. SiF_4

(Total 1 mark)

2. What amount (in moles) is present in 2.0 g of sodium hydroxide, NaOH?

A. 0.050

B. 0.10

C. 20

D. 80

(Total 1 mark)

3. What is the electron configuration for the copper(I) ion, (Z = 29)?

A. $[Ar]4s^2 3d^9$

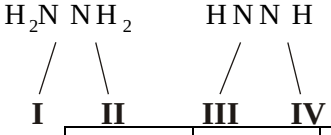
B. $[Ar]4s^1 3d^{10}$

C. $[Ar]4s^1 3d^9$

D. $[Ar]3d^{10}$

(Total 1 mark)

4. What is the hybridization of nitrogen atoms I, II, III and IV in the following molecules?



	I	II	III	IV
A.	sp^2	sp^2	sp^3	sp^3
B.	sp^3	sp^3	sp^2	sp^2
C.	sp^2	sp^2	sp	sp
D.	sp^3	sp^3	sp	sp

(Total 1 mark)

5. Consider the following statements.

I. All carbon-oxygen bond lengths are equal in CO_3^{2-}.

II. All carbon-oxygen bond lengths are equal in CH_3COOH.

III. All carbon-oxygen bond lengths are equal in CH_3COO^-.

Which statements are correct?

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

(Total 1 mark)

6. Which is correct about the element tin (Sn) (Z = 50)?

	Number of main energy levels containing electrons	Number of electrons in highest main energy level
A.	4	4
B.	4	14
C.	5	4
D.	5	14

(Total 1 mark)

7. Avogadro's constant has the same value as the number of

A. molecules in 1 mol of solid iodine.
B. atoms in 1 mol of chlorine gas.
C. ions in 1 mol of solid potassium bromide.
D. protons in 1 mol of helium gas.

(Total 1 mark)

8. Which electrons are lost by an atom of iron when it forms the Fe^{3+} ion?

A. One s orbital electron and two d orbital electrons
B. Two s orbital electrons and one d orbital electron
C. Three s orbital electrons
D. Three d orbital electrons

(Total 1 mark)

9. What is the molecular geometry and the Cl–I–Cl bond angle in the ICl_4^- ion?

A. Square planar 90^o
B. Square pyramidal 90^o
C. Tetrahedral 109^o
D. Trigonal pyramidal 107^o

(Total 1 mark)

10. How many sigma (σ) and pi (π) bonds are present in the structure of HCN?

	σ	π
A.	1	3
B.	2	3
C.	2	2
D.	3	1

(Total 1 mark)

11. Which types of hybridization are shown by the carbon atoms in the compound $CH_2 = CH - CH_3$?

I. sp
II. sp^2
III. sp^3

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

(Total 1 mark)

12. A transition metal ion X^{2+} has the electronic configuration $[Ar]3d^9$. What is the atomic number of the element?

A. 27
B. 28
C. 29
D. 30

(Total 1 mark)

13. Which equation represents the third ionization energy of an element M?

A. $M^+(g) \rightarrow M^{4+}(g) + 3e^-$
B. $M^{2+}(g) \rightarrow M^{3+}(g) + e^-$
C. $M(g) \rightarrow M^{3+}(g) + 3e^-$
D. $M^{3+}(g) \rightarrow M^{4+}(g) + e^-$

(Total 1 mark)

14. What is the electron configuration for an atom with Z = 22?

A. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$
B. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^2$
C. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^2 4p^2$
D. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$

(Total 1 mark)

15. Which properties are typical of d-block elements?

I. complex ion formation
II. catalytic behaviour
III. colourless compounds

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

(Total 1 mark)

16. Which salts form coloured solutions when dissolved in water?

I. $FeCl_3$
II. $NiCl_2$
III. $ZnCl_2$

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

(Total 1 mark)

17. When Na, K, and Mg are arranged in **increasing** order of atomic radius (smallest first), which order is correct?

A. Na, K, Mg
B. Na, Mg, K
C. K, Mg, Na
D. Mg, Na, K

(Total 1 mark)

18. Methane, CH_4, burns in oxygen gas to form carbon dioxide and water. How many moles of carbon dioxide will be formed from 8.0 g of methane?

A. 0.25
B. 0.50
C. 1.0
D. 2.0

(Total 1 mark)

19. When excess $BaCl_2(aq)$ was added to a sample of $Fe(NH_4)_2(SO_4)_2(aq)$ to determine the amount in moles of sulfate present, 5.02×10^{-3} mol of $BaSO_4$ was obtained. How many moles of sulfate ions and iron ions were in the sample of $Fe(NH_4)_2(SO_4)_2$?

	Amount of sulfate ions / moles	Amount of iron ions / moles
A.	5.02×10^{-3}	2.51×10^{-3}
B.	10.04×10^{-3}	5.02×10^{-3}
C.	2.51×10^{-3}	5.02×10^{-3}
D.	10.04×10^{-3}	2.51×10^{-3}

(Total 1 mark)

20. What is the empirical formula of a compound containing 50% by mass of element X (A_r = 20) and 50% by mass of element Y (A_r = 25)?

A. XY
B. X_3Y_2
C. X_4Y_5
D. X_5Y_4

(Total 1 mark)

21. Which equation represents the first ionization energy of fluorine?

A. $F(g) + e^- \rightarrow F^-(g)$
B. $F^-(g) \rightarrow F(g) + e^-$
C. $F^+(g) \rightarrow F(g) + e^-$
D. $F(g) \rightarrow F^+(g) + e^-$

(Total 1 mark)

22. The temperature in Kelvin of 1.0 dm^3 of an ideal gas is doubled and its pressure is tripled. What is the final volume of the gas in dm^3?

A. 1/3
B. 2/3
C. 3/2
D. 1/6

(Total 1 mark)

23. How many hydrogen atoms are in one mole of ethanol, C_2H_5OH?

A. 1.00×10^{23}
B. 3.61×10^{24}
C. 5.00
D. 6.00

(Total 1 mark)

24. Ethyne, C_2H_2, reacts with oxygen according to the equation below. What volume of oxygen (in dm^3) reacts with 0.40 dm^3 of C_2H_2?

$$2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(g)$$

A. 0.40
B. 0.80
C. 1.0
D. 2.0

(Total 1 mark)

25. Air bags in cars inflate when sodium azide decomposes to form sodium and nitrogen:

$$2NaN_3(s) \rightarrow 2Na(s) + 3N_2(g)$$

Calculate the amount, in moles, of nitrogen gas produced by the decomposition of 2.52 mol of $NaN_3(s)$.

A. 1.68
B. 2.52
C. 3.78
D. 7.56

(Total 1 mark)

26. Which of the reactions below occur as written?

I. $Br_2 + 2I^- \rightarrow 2Br^- + I_2$

II. $Br_2 + 2Cl^- \rightarrow 2Br^- + Cl_2$

A. I only
B. II only
C. Both I and II
D. Neither I nor II

(Total 1 mark)

27. What is the coefficient for $H_2SO_4(aq)$ when the following equation is balanced, using the smallest possible integers?

$$\_\_Mg_3N_2(s) + \_\_H_2SO_4(aq) \rightarrow \_\_MgSO_4(aq) + \_\_(NH_4)_2SO_4(aq)$$

A. 1
B. 3
C. 4
D. 7

(Total 1 mark)

28. Which property decreases down group 7 in the periodic table?

A. atomic radius
B. electronegativity
C. ionic radius
D. melting point

(Total 1 mark)

29. When the following bond types are listed in decreasing order of strength (strongest first), what is the correct order?

A. covalent > hydrogen > van der Waals'
B. covalent > van der Waals' > hydrogen
C. hydrogen > covalent > van der Waals'
D. van der Waals' > hydrogen > covalent

(Total 1 mark)